SELECTING AND TREATING MINNESOTA WOODS FOR FENCE POSTS

Fred Carlson
Lewis T. Hendricks

Untreated cedar post—sapwood at groundline has been destroyed by fungi after only 2 years of service. The heartwood is completely sound. (Photo courtesy of North Carolina State University)

Agricultural Extension Service University of Minnesota

In the years when labor was relatively inexpensive and naturally durable woods were within easy reach of the average farm budget, chemical treatment of wood fencing was unnecessary. Today, both the price and availability of durable woods have changed. Most untreated fencing now cut in Minnesota has a service life under 15 years. A good chemical treatment and proper selection of fencing materials can add 10-25 years to this service life while decreasing long term fencing costs.

Decay fungi or "wood rot" causes most of the deterioration of fence posts in Minnesota. By eliminating or changing the form of any of the factors promoting decay, a fence post can be made more durable. The four decay promoting factors follow:

- Heat (20-35 C^{O} or 68-95 F^{O})
- Moisture content (20% +)
- Oxygen
- Food (cellulose and wood sugars)

In normal service, groundline conditions where both adequate moisture and oxygen are present are most favorable to decay. Far below the groundline the lack of oxygen limits fungal growth, and above ground, fungal growth is checked by a lack of moisture due to air drying. Some fungi can survive only in a narrow temperature range or reproduce only in sunlight. The most effective decay prevention method today is wood treatment with an effective and safe chemical toxicant, which essentially removes the food source from the decay fungi. Decreasing the amount of oxygen, controlling moisture content or temperature in the posts will add to the service life of posts.

Both cellulosic fibers and the wood sugars found in wood are used as a food source for wood-rotting fungi. The most widely used method of limiting decay is contaminating or changing the form of existing food sources.

The typical Minnesota post size is cut from a sapling 3-6 inches in diameter. These posts consist of two general regions—the sapwood and the heartwood.

Sapwood

Light-colored, porous, young wood just beneath the bark. Conducts food and minerals between leaves and roots. Decays quickly. Soaks up penta readily.

Heartwood

Dark, old, dead wood in center of tree, forming its support. More durable than sapwood; often very decay-resistant: difficult to treat.

Good Posts for Treating

—have a minimum of heartwood.
—have at least one inch of sapwood surrounding the heartwood.

The center portion of the post, the heartwood, is generally more decay resistant than sapwood of the same species. This durability difference is due largely to the presence of toxic substances in the heartwood. The low penetrability of the heartwood makes it difficult to absorb the preservative satisfactorily. The ease of penetration of the sapwood is important to the effectiveness of the preservative treatment. In a treated post, the untreated heartwood portion is protected by a shell of treated sapwood.

Few species native to Minnesota are suitable for use as untreated fence posts. Even then only heartwood is decay resistant. Eastern red cedar, found mostly in southeastern Minnesota, contains materials toxic to typical wood rotters. White oak and northern white cedar are also moderately decay resistant. The heartwood of these species is more decay resistant than the sapwood. There is little difference in the longevity of untreated sapwood of any species, with most lasting only 2-3 years when placed in the soil. Some species, such as aspen, may be susceptible to decay even after treatment. This is believed caused by the irregular pattern of preservative penetration and retention in aspen wood, even where pressure-type processes are used. Table 1 lists the natural heartwood durability of some commercially available and native fencing materials.

Table 1. Durability of the heartwood of native or commercially available posts in Minnesota

Durability	Species	Life expectancy of untreated heartwood (years)
Very durable	Eastern red cedar	30+
	Redwood	10-30*
Durable	White and burr oak	10-15
	Northern white cedar	5-15
Moderately durable	Tamarack	8-10
	Red oak	6-8
	Douglas fir	4-6
Nondurable	Red and jack pine	2-6
	Aspen (poplar) and cottonwood	3-4
	Ponderosa pine	3-4
	White birch	3-4
	Spruce and balsam fir	3-4
	Basswood	< 5
	Maples	2-4
	Ashes	< 5
	Willow	< 5

*Although tests at the Forest Products Laboratory in Madison, Wisconsin show that redwood durability can be good, it is at best quite variable. Their recommendation is treatment of redwood whenever it is used in ground contact.

Fortunately several easily treated species such as tamarack, red oak, red, and jack pine are native to Minnesota. Although only moderately durable to nondurable when untreated, these species can be easily treated with preservatives to achieve conforming penetration and retentions.

The expense of treating posts should be outweighed by longer service life and lower maintenance costs. Preservation can be accomplished by either a pressure treatment process or one of several cheaper, less complicated nonpressure methods.

Pressure Treatment

By forcing the preservative into the wood under pressure, good penetration and retention is usually achieved. Vacuum and pressure force the preservative into the posts. Pressure treatment is a very effective process, but the high initial capital investment and complicated technology make it practical only for commercial treating plants. Pressure-treated posts can be purchased directly from a lumber dealer. Chemicals used most often in pressure treatment include pentachlorophenol, coal-tar creosote, or waterborne salt preservative.

NONPRESSURE TREATMENTS

Nonpressure treatments are usually less effective; however, the preservative treatments are more easily accomplished and apt to be less complicated.

Brushing or Spraying

Applying a preservative to the surface of fence posts results in relatively poor penetration. Experience has proven that when chemical preservative is brushed or sprayed on there is usually less than 1/10 of an inch penetration into sapwood on the side of the post. Normal splitting and checking of the posts after treatment create breaks in the thin, treated shell, allowing premature decay.

Dipping

A quick dip in a preservative solution can be more effective than a brushed or sprayed application. The solution more effectively penetrates the wood structure and more surface is contacted by the preservative. A disadvantage of dipping, as with the spray treatment method, is the general lack of penetration. Organic preservatives dissolved in a light oil carrier, such as mineral spirits or water-soluble salt preservatives, could be used in the dipping treatment. Even with more effective preservatives such as pentachlorophenol or using high preservative temperatures during application, the poor penetration of the dipping and surface application make them not worth the dollars invested.

Double Diffusion

Leaching of waterborne preservatives from the treated posts can be lessened in the double diffusion method of water soluble treatment.* When a post is placed in a solution of high preservative concentration, the water soluble preservative diffuses into the post toward the area of low concentration. The post is then soaked in a second water soluble solution which also diffuses into the post and reacts chemically with the first preservative. The resulting product is a nonleachable preservative with good penetration. Double diffusion with sodium fluoride-copper sulfate yields an effective treatment but is expensive and time consuming. Disposal of unused preservative solutions is a problem with all do-it-yourself treatments whether it is creosote, pentachlorophenol, or waterborne salts. Careful monitoring is essential.

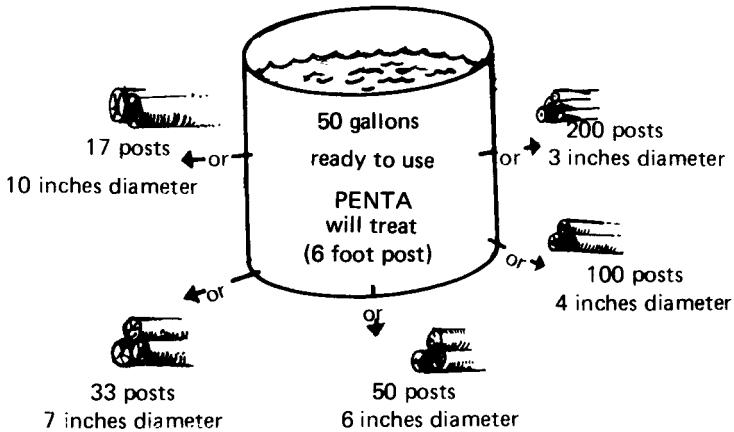
*For more information on the double diffusion process, see "How to Treat Fence Posts by Double Diffusion," U.S. Forest Products Laboratory Note, FPL-013, 1963. (Madison, Wisconsin).

Soaking

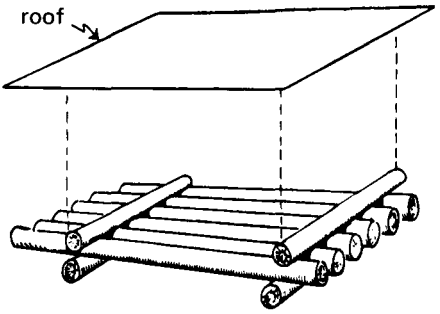
A soaking process is the most practical method of treating fence posts on a small scale. Coal-tar creosote, pentachlorophenol, copper naphthenate, or water-borne preservatives are the chemicals normally used. The coal-tar creosote gives good results, but must be heated during the application. The heat is necessary to lower the viscosity of the solution and allow penetration in the post. NOTE: There is a Federal Specification No.TT-C-655 called Creosote Technical Wood Preservative for brush, spray, or open tank treatments. This especially formulated creosote does not become viscous at room temperature. Copper naphthalene can also be used in a 1-2 percent metallic copper solution when diluted with mineral spirits or naphtha.

The best results are obtained with a 5 percent solution by weight, of pentachlorophenol and a petroleum solvent. The 5 percent solution corresponds to 1 gallon of penta concentrate to 10 gallons of solvent. Pentachlorophenol can be obtained in crystalline or liquid concentrate form and is relatively inexpensive, safe if handled according to the directions on the label, and easily applied. A number 2 fuel oil can be used as the solvent or mineral spirits can be used when the surface is to be painted.

Species to be treated by soaking should be debarked, thoroughly seasoned, contain a high percentage of sapwood, and be relatively free of nonfibrous materials. Red oak and some pines are easily treated, but aspen does not take a good, even treatment. Red or jack pine yields the most satisfactory post when conditioned to 25 percent moisture content or less and soaked 48 hours. In test plots, 98 percent of the jack pine posts treated in a 48-hour cold soak were still in service after 27 years. Posts to be treated must be debarked to get good, even penetration.



Posts cut in the spring are easily peeled with a draw-knife, an axe, or a straightened garden hoe. They should be open piled with at least 3 inches between posts, stickered to allow circulation above and below, covered and air dried for 6-12 months or until checking is evident in the ends of the post. The posts should then be cut to the final size and any necessary holes drilled before treatment. Cutting or drilling after treatment means the newly exposed surfaces need to be retreated with preservative.



A stack of peeled posts, piled for seasoning prior to treatment.

Two major types of soaking tanks are commonly used. The simplest type is an upright 55-gallon drum partially set in the ground and fitted with a cover. One barrel can be used for treating the posts, although at least two barrels welded together are necessary to submerge the post for good total treatment. Two barrels welded together and cut in half, lengthwise, make a horizontal tank.

Posts should be completely submerged and treated for the desired retention. Two methods can be used to determine when this happens: 1) when the preservative has penetrated about half the radius or 80-90 percent of the sapwood depth of the post; and 2) after at least 48 hours, which is recognized as the minimum treatment time.

An alternate, more complicated method of determining retention is to soak the post until a desired weight of the solution has been absorbed. In an unpublished study at the University of Minnesota, preservative retention of jack pine was 2.27 lb/cubic foot for a 24-hour cold soak in a 5 percent pentachlorophenol solution and 2.64 lb/cubic foot for a 48-hour soak. Longer soaking didn't measurably increase the retention. Retention varies with posts, but average absorption of preservative should be about 3.6 lb/cubic foot for black ash and 1.4 lb/cubic foot for red and white oak. The post volume can be determined by multiplying the average radius squared x 3.142 x the post height.

Table 2. Minnesota species easily preserved using the cold soak method*

Softwoods	Hardwoods
Jack pine	Red oak
Red pine	White oak
Eastern white pine	Burr oak
Eastern red cedar	White birch
Northern white cedar	Maple

*This assumes the material being treated is in roundwood form, has a reasonable amount of sapwood present, and has been conditioned to a 25 percent moisture content or less. With the possible exception of red oak, the heartwood of species listed in this table would be difficult to penetrate using the cold soak method. The authors of this publication recommend pressure treatment in the latter case.

Preservative retention can be increased by increasing the height of the barrels, which increases the hydrostatic pressure on the butt of the post at the bottom of the tank. There is economy in filling the tank with a few inches of water and allowing the water to penetrate into the butt of the post and decreasing the preservative uptake. The decreased protection at the butt of the post doesn't significantly decrease the durability as the post is inserted well below groundline in an area of low decay action.

The liquid penta solution is suggested because the powder can be very irritating to the mucous membranes of the respiratory tract as it is being mixed. When the posts are removed from the soak they should be thoroughly rinsed with water and allowed to dry with a minimum of handling.

PRECAUTIONS

Penta can be irritating to the skin; use synthetic rubber gloves to protect hands.

Washing at once with soap and water will remove the solution if it gets on hands or face.

Follow the same fire precautions you would around any fuel oil.

Certain illustrations in this publication have been reproduced from Home Treatment of Wooden Fence Posts with permission of the Agricultural Extension Service, University of Arkansas.

Fred Carlson is former assistant extension specialist, Forest Products, University of Minnesota, now with Research and Development, Wood Products Division, Potlatch Corporation, Lewiston, Idaho. Lewis T. Hendricks is extension specialist Forest Products, University of Minnesota.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. We offer our programs and facilities to all persons without regard to race, creed, color, sex, age, or national origin.